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Costs of STORING and FEEDING CHOPPED and BALED HAY

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CONCLUSIONS

- Costs of storing chopped and baled hay were similar on the farms studied.

- Equipment and labor costs were higher for feeding chopped hay than for baled hay. These higher feeding costs for chopped hay may or may not offset lower harvest and storage requirements.

- The distance hay had to be transported in the mow affected the time required to feed both chopped and baled hay. An increase in the distance chopped hay was moved resulted in a proportionally larger increase in labor than for baled hay. When both baled and chopped hay were moved less than 10 feet, the difference in labor time required was small.

- Transporting and feeding time accounted for a large part of the total hay handling time. However, the overhead time of climbing in and out of the mow and between hay drops could be spread over more pounds of hay if two feedings could be thrown down at one time. Also, once a day feeding could be used to an advantage on some farms.

- Tons of storage capacity affect the storage cost per ton. Large capacity storage structures have a lower cost per ton of capacity than small barns.

- Open sided hay barns had lower costs for less than 100 tons than a sided pole barn. Over 100 tons, the costs per ton were similar. Investment and annual storage cost per ton declines very slowly after a capacity of 100 tons is reached.

- Costs of hay storage increase rapidly when less than the capacity of the barn is used.

- Waste was considered a major problem by farmers feeding baled hay.

COST OF STORING AND FEEDING CHOPPED AND BALED HAY

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INTRODUCTION

Development of new production and hay handling techniques may change what was once the most desirable hay storage and feeding method. A farmer must continually weigh and compare alternative methods, selecting the most efficient for his particular situation.

More than two and one-fourth million acres of hay are harvested in Ohio each year. Most of it is stored in barns and fed to livestock on farms where it is produced. Forage consuming livestock numbers have increased per farm during the past few years while the labor supply has declined. Efficiency in storing and handling a large volume of hay is important. Farmers are especially interested in reducing the labor involved in handling hay because of the physical effort encountered and the rapid increase in labor cost (31 percent since 1950).

The automatic field baler and field forage harvester offer farmers several alternative methods of handling meadow crops. The decision of how to harvest, store and feed hay is a difficult one to make because of the many alternatives confronting each farmer.

WHY THE STUDY WAS MADE

This study was conducted to provide information on the cost of storing and feeding baled and chopped hay.

METHOD

Forty-seven central Ohio dairy farms feeding baled or chopped hay were selected for detailed study in the winter of 1957. At least two visits were made to each farm. On the first visit, information was obtained on hay storage capacity, amount stored, feeding equipment, herd size and the amount of hay fed each day. On the following visit, time and motion studies were made, of the feeding operation, using a stop watch. Information was also obtained on the distance the worker traveled and the hay transported. The main hay removal and feeding operations were compared for chopped and baled hay. Feeding of small quantities to a bull or a few animals in another location was not included.

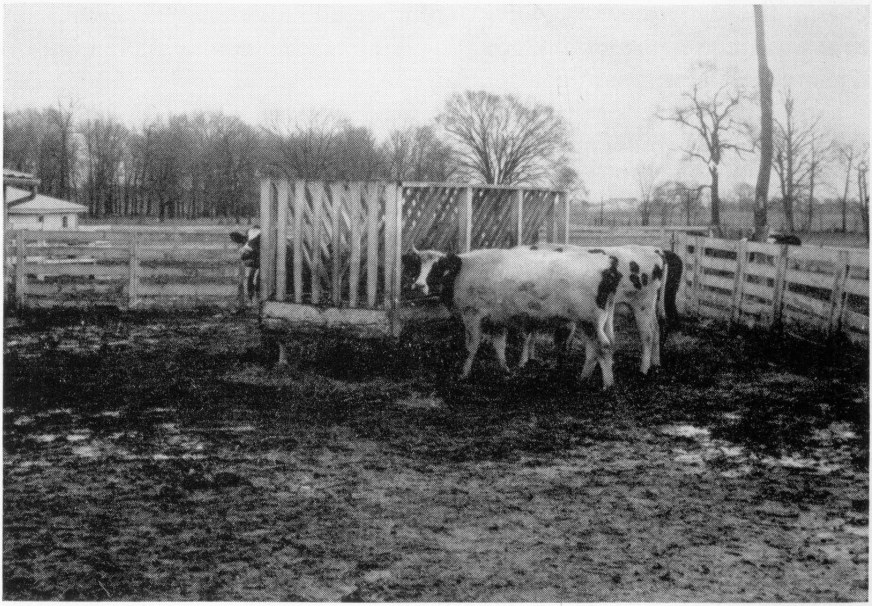
FINDINGS

FEEDING HAY

Baled Hay

The rate at which hay was transported in the mow was a function of the distance moved. Forty-four men were timed on the 25 farms feeding baled hay. On these farms, the hay was moved an average of 29 feet in the mow. Baled hay transported 10 feet was moved at the rate of .44 minutes per hundred pounds. Moving baled hay 40 feet in the mow took an average of .74 minutes per hundred pounds fed. This was a 68 percent increase in the time required so that for each additional 10 feet the hay was moved in the mow, 20 percent more time was required.

The method of transporting hay varied with the distance it was moved. Bales were usually picked up and thrown when hay was moved under 15 feet. Between 15 and 30 feet farmers picked up and carried the bales one at a time. When the distance was more than 30 feet, most farmers stacked two or three bales and dragged them from the storage to place of feeding or to the drop chute.



Labor is increased when hay is transported a greater distance to feeding racks.

TABLE 1.—Labor Required and Distance the Man Traveled to Feed Baled and Chopped Hay on 47 Ohio Farms, 1957*

(per feeding)

Operation	Baled (25 farms)		Chopped (22 farms)	
	Feet	Minutes	Feet	Minutes
Climb in and out of mow	18.8	.31	25.9	.38
Travel between drops in mow	42.8	.46	43.0	.59
Transport hay to drop	163.8	2 97	142.5	6.62
Transporting and distributing in feed rack	185.5	3 32	92.1	1.42
Total	410.9	7.06	303.5	9.01
Per 100 pounds fed	115.1	1.97	85.7	2.55

*An average of 357 pounds of baled hay and 354 pounds of chopped hay was fed.

Transportation of hay in the mow is only one part of the feeding operation. Strings or wires must be removed, bales broken and the hay distributed for the complete feeding operation. Breaking bale ties and distributing hay required an average of .96 minutes per 100 pounds fed.

Chopped Hay

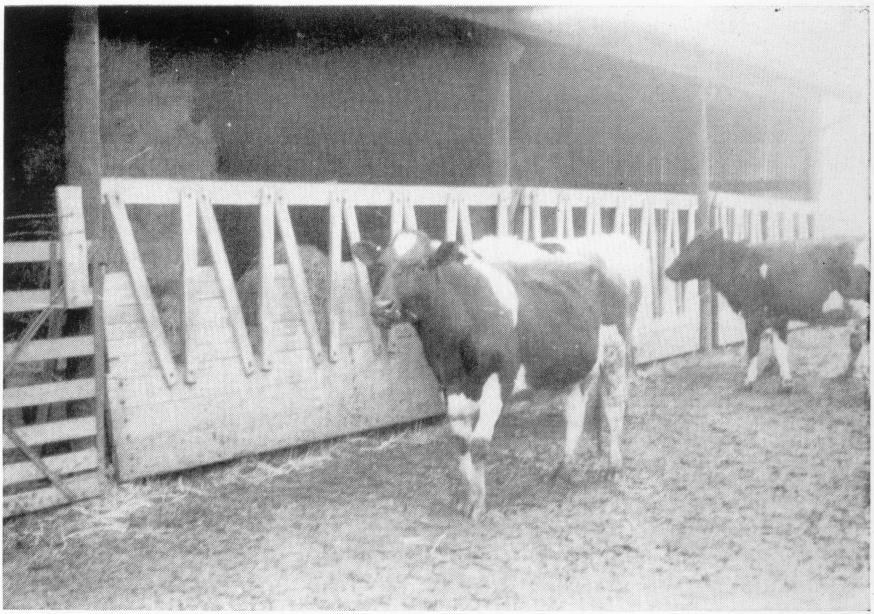
Transportation distance in the mow had a much greater affect on labor time for moving chopped hay than for baled. Chopped hay handling was studied on 22 farms. These farmers moved chopped hay in the mow an average of 14 feet, ranging from 5 to 51 feet. Chopped hay transported 10 feet from storage to the drop chute or feed rack required 1.85 minutes per hundred pounds. The labor time increased to 3.92 minutes per hundred pounds when chopped hay was moved 30 feet in the mow, or an increase of 119 percent. This was a 60 percent increase in time for each additional 10 feet of transportation distance.

A bent tine fork was used by 20 of the farmers to pull the hay loose and a silage fork to move it. Two farmers used pushers to move a pile of chopped hay long distances. These pushers consisted of a handle with a wide V shaped blade.

Chopped hay was pushed directly into the feeding rack from the mow. Hay feeding racks were located under drop openings in the floor of raised mow barns. Some farmers had mow floor openings along an entire side of their barn facilitating feeding and minimizing travel distance in the mow. In a one story ground level barn, the hay was moved directly into the feed rack. In either type of barn, a separate feeding operation for chopped hay was eliminated.

More time is required to feed hay than the actual transportation and feeding time. Climbing into and out of the mow, walking between mows and feeding locations are parts of the feeding operation. The time required for these activities was about the same regardless of the quantity of hay removed and fed. Some differences in this overhead time exist. For example, ground level mows had less up and down or ladder time than raised mow or bank barns.

Chart 1 shows the effect that the distance baled and chopped hay was transported had on labor time. A similar quantity of chopped hay can be moved almost as rapidly as baled hay for a very short distance. Labor time increased rapidly as the distance for the moving of chopped hay lengthened. Moving large quantities of chopped hay much over 10 feet required several times the labor effort. Feeding chopped hay in barns designed for loose or baled hay required much more labor than for baled hay. Labor requirements were kept to a minimum if chopped hay was moved less than 10 feet. Farmers using chopped hay also fed some baled hay. The movement of chopped hay long distances or to another barn was difficult and labor consuming. Bales were easily moved and fed.



Feeding time is reduced when feeding facilities are part of storage area.

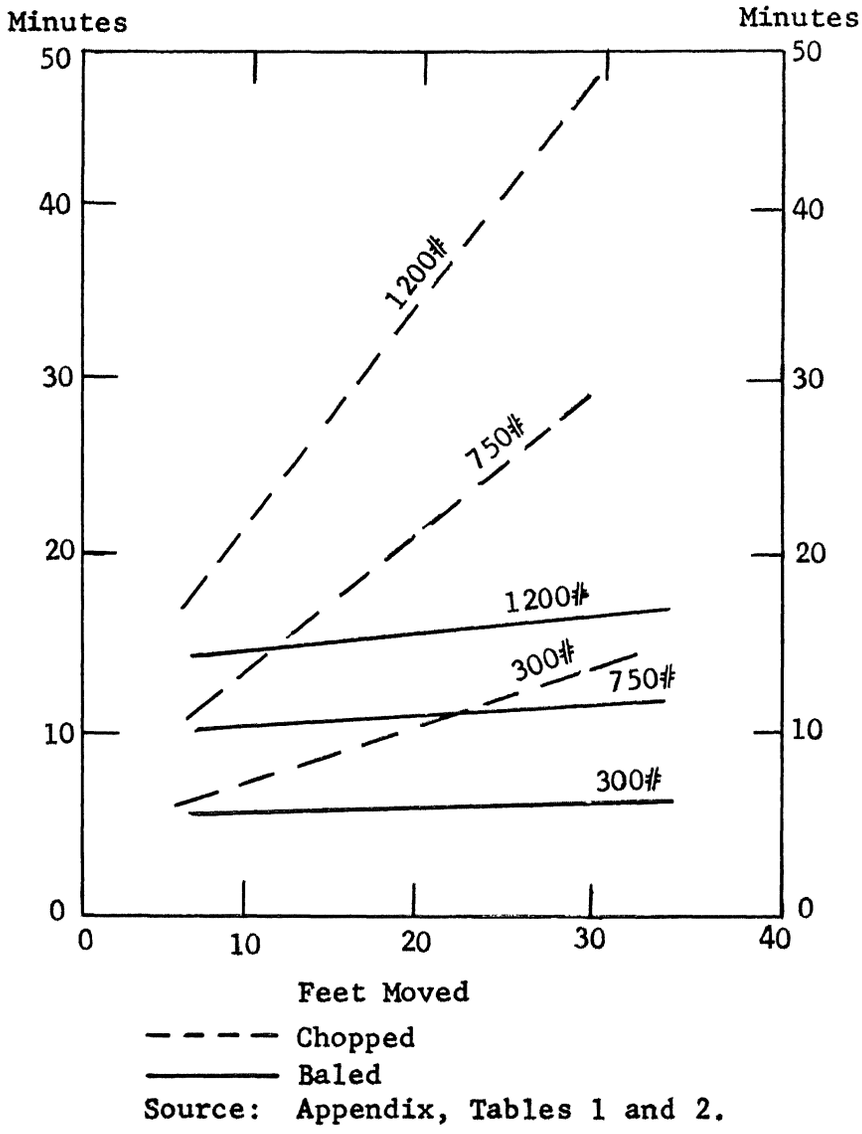


Chart 1.—Total labor required per feeding to feed selected amounts of baled and chopped hay, by distance moved, Ohio, 1957.

Distance baled hay was moved had a slight affect on labor time. Farmers have been flexible in their methods of moving bales out of the mow, throwing, rolling down, carrying or dragging several bales at one time. Usually as the distance increased in the mow where hay was moved, the handling method was altered.

Total labor time required for feeding hay decreased per 100 pounds as the amount used at one feeding increased. Labor for climbing into and out of the mow was about the same for a feeding of 300 pounds as it was for 900 pounds. Three times the labor for getting in and out of the mow must be charged to each pound of hay when 300 pounds were removed compared to 900 pounds. While this time is small for each feeding, it builds up to a lot of time and effort in a year. A large amount of labor time and effort could be saved if more hay could be removed from the mow each trip. (Perhaps removing a day's supply on one trip rather than climbing into the mow for each feeding.)

HAY STORAGE COSTS

General purpose balloon frame barns were by far the most common type of structure used to store both baled and chopped hay. Pole type shed barns were used on three farms for the storage of baled hay. The barns included in this study ranged in age from one to about 100 years. Most of the general purpose barns had been constructed for the storage and feeding of long loose hay. Mow floors were strengthened or the barns were used at less than capacity when filled with chopped or baled hay. Very few farmers indicated they would replace these barns with ones of similar size or type.

TABLE 2.—Capacity and Tons of Baled and Chopped Hay Stored on 47 Ohio Farms, 1957*

Type of hay	Number of farms	Tons		Percent of capacity used
		Capacity	Stored	
Baled	25	131	74	56
Chopped	22	145	84	58

*Capacity determined at 250 cubic feet per ton.

Replacing existing barns with buildings of the same design would cost about $44 per ton for either chopped or baled hay. It was assumed that farmers would replace their hay storage structures with those that could be used to capacity and at a lower investment cost per ton. A pole type building with a lower investment and shorter life was selected as the type structure most farmers would use. Costs were computed from contractor erected prices, costs reported by farmers and from the cost of materials plus construction costs. Capacities of all building structures were computed for the volume a farmer could use with reasonable ease. Generally, a farmer would want some excess hay storage capacity for variation in yields and carryover needs.

TABLE 3.—Costs by Selected Capacities of Chopped or Baled Hay Stored in Hay Keepers, Ohio, 1959

(26 feet wide, 18 feet to the square)

Tons*	Building Length (feet)	Investment cost		Annual cost per ton
		Total	Per ton	
87	45	$1816	$20.87	$1.46
112	60	2350	20.98	1.47
140	75	2884	20.60	1.44
168	90	3418	20.35	1.43

*Two hundred and fifty cubic feet per ton.

Two types of structure were used to obtain the storage costs. These were an open sided pole hay keeper and a pole barn. The hay keeper was 26 feet wide, 18 feet high to the square and was expandable in 15.5 foot bents. The sides of this building were open. Only the gables were sided. The roof extended for 8 feet on either side for protection of the hay and animals when feeding. An increase in the size of this type of building had very little effect on the investment or storage cost per ton.

The basic pole barn was 45 feet wide and 13 feet to the square on the high side. This structure could also be expanded in 15.5 foot multiples. The barn is sided on three sides. Half of the floor area was used for hay storage, the remainder for livestock housing. In estimating the hay storage cost, one-half of the cost was charged to the hay storage and the other half to livestock or other uses.

Some reduction in the investment and the annual use cost per ton was found with larger pole barns. The annual storage cost was $1.76 per ton for a 71 ton capacity barn compared to $1.45 per ton for a 162 ton barn. This reduction in cost is realized because a proportionately smaller area of siding is needed for larger tonnages of hay.

Annual costs included: depreciation at 2.5 percent of new value, insurance at $3.60 per $1000 on replacement value, interest at 5 percent of midlife value, taxes at 24 mills on 40 percent of new value and repairs at one percent of new value. The total of the annual storage costs were divided by the tonnage capacity.

The average cost of storing baled or chopped hay on the 47 farms was about $1.76 per ton in a pole barn or $1.46 in an open sided hay feeder. Barns must be used at capacity to enjoy a low storage cost per ton. Most of the farmers in the study were not able to use their hay storage to capacity. In fact, only about 60 percent of capacity was

TABLE 4.—Costs by Selected Capacities of Chopped or Baled Hay Stored in Pole Barns, Ohio, 1959

(45 feet wide, 13 feet to square)

Tons*	Building Length (feet)	Investment cost		Annual cost per ton
		Total†	Per ton	
71	61	$3551	$25 01	$1 76
108	92	4761	22 04	1 54
144	123	6031	20 94	1 47
162	138	6636	20 48	1 45

*Two hundred and fifty cubic feet per ton

†Total for building, 50 percent of total charged to hay

in use. Using a barn at less than the capacity, increases the storage cost per ton. For example, the annual cost of storing 71 tons of hay was $1.76 per ton when the barn was used at capacity. The cost increased to $2.20 per ton if 80 percent was used or 57 tons were stored and $2.93 per ton at 60 percent or 43 tons.

FEEDING FACILITIES

Wide variations were found in the facilities used to feed hay. These ranged from floor to ceiling feed racks to feeding hay on the ground in an open field. The V type rack with feeding space on both sides was typically used for baled hay. These racks were movable. Often they were used outside of the barn. Farmers feeding baled hay with V type racks provided an average of 26 inches per cow.

It was estimated that replacing these V type feed racks would cost $1.75 per foot of feeding space or $3.80 for each cow. A 10 foot section of rack would provide 20 feet of feeding space adequate for nine cows and cost $35 to build. The useful life of this type feed rack was estimated at 15 years.

Chopped hay was usually fed in a bunk which had an enclosed tight sided V chute holding the hay (like a self feeder) and letting it drop into the bunk as it was eaten. These feeders usually reached the ceiling and were filled from mow level. Farmers feeding chopped hay provided an average of 27 inches of feeding space per cow. These chopped hay feeders cost $1.95 per foot of feeding length or $4.39 per cow. Both single and double side feeders were found in use. Chopped hay feeders were usually constructed in place as a permanent fixture and were always under roof. The estimated life for these feeders was 20 years.

OPERATING PROBLEMS

Waste was a major problem on farms feeding baled hay. The cows pulled large amounts of hay from the feed bunk, dropping it on the ground and tramping under foot. Farmers estimated as much as 10 percent of the total amount fed was lost in this way. Most of the farmers feeding chopped hay did not consider waste a problem.

Moldy hay was cited by nine of 25 farmers feeding baled hay. Only four of the 22 farmers feeding chopped hay reported they had difficulty with mold. However, nine farmers feeding chopped hay reported excessive dust in the mow during harvest and feeding. Broken bales were considered a problem by several men feeding baled hay.

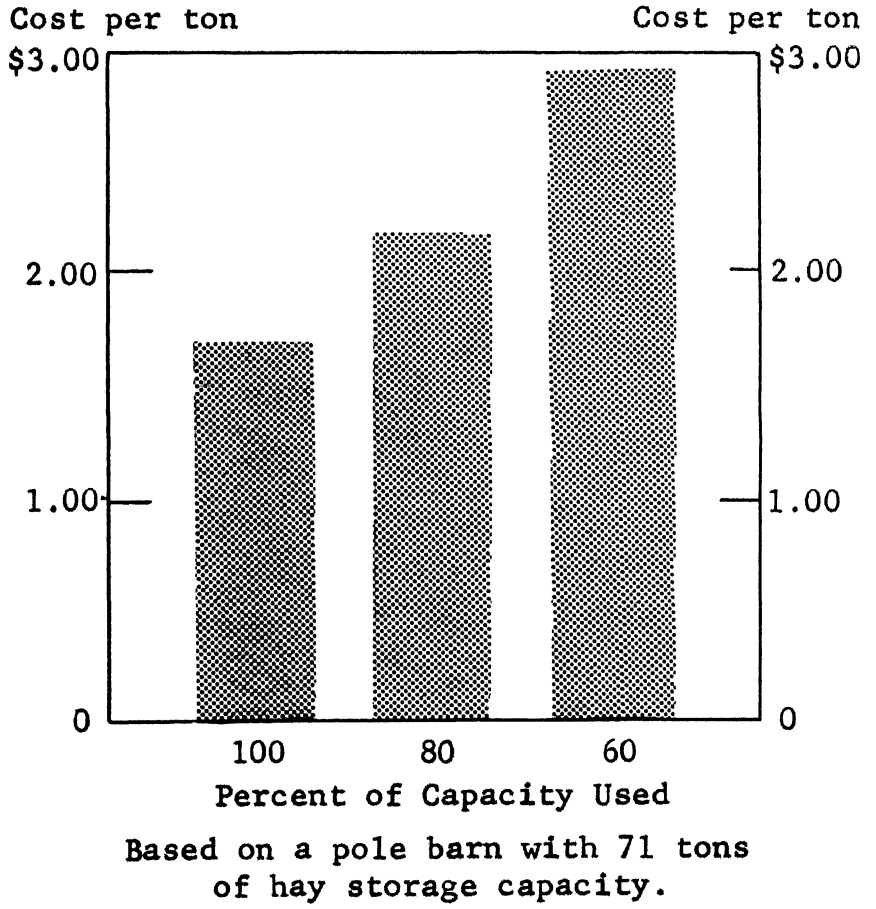


Chart 2.—Cost of storing hay in a pole barn at three levels of capacity utilization, Ohio, 1957.

Ten farmers feeding both chopped and baled hay reported their chopped hay to be more palatable and of higher quality. None of the 47 farmers reported any difficulty with sore mouths from feeding either chopped or baled hay. A 3 to 4 inch length of cut was used by most of the farmers chopping hay.

APPENDIX

TABLE 1.—Labor Required in Minutes to Remove and Feed Chopped Hay by Weight and Distance Moved, Ohio, 1957

Pounds fed	Feet hay moved			
	10	20	30	40
300	6.6	9.6	12.8	15.9
750	15.0	22.7	30.5	38.2
1200	23.3	35.7	48.1	60.5

TABLE 2.—Labor Required in Minutes to Remove and Feed Baled Hay by Weight and Distance Moved, Ohio, 1957

Pounds fed	Feet hay moved			
	10	20	30	40
300	4.7	4.9	5.1	5.2
750	9.7	10.2	10.7	11.1
1200	14.9	15.6	16.4	17.1